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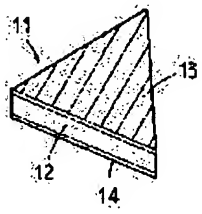
(71)Applicant : **MURATA MFG CO LTD**
(72)Inventor : **HAYASHI MASATAKE**
SHIRATSUYU KOUSUKE
ANDO AKIRA
KIKKO TOSHIHIKO
YONEDA YASUNOBU
SAKABE YUKIO

(54) PIEZOELECTRIC RESONATOR

(57)Abstract:
PURPOSE: To obtain the piezoelectric resonator of a smaller or larger size even when the operating frequency is the same by adopting n-polygon (n is an integer being 3 or over except 4) for the plane shape of both major sides of a piezoelectric layer.
CONSTITUTION: The shape of a major side of a piezoelectric layer on which exciting electrodes 13, 14 of a piezoelectric resonator 11 are formed is selected to be n-polygon (n is an integer being 3 or over except 4). Thus, the vibration attitude is changed depending on the value (n) and the resonator is resonated in various frequencies. Thus, a small sized piezoelectric resonator having not been obtained by a conventional resonator is obtained and a piezoelectric resonator whose size has been too small and which is not practical is realized through the use of the spread vibration mode by selecting various shaped piezoelectric resonators resulting from the revision of the value (n) even when the frequency is the same.



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JAPANESE [JP,05-218789,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS OPERATION DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] The piezo resonator characterized by the flat-surface configuration of both the principal planes of said piezo electric crystal layer being n square shape (however, integer excluding [n] three or more 4) in the piezo resonator which has the structure where at least two or more electrodes for excitation were formed in both sides of this piezo electric crystal layer on both sides of the piezo electric crystal layer.
[Claim 2] The piezo resonator according to claim 1 whose flat-surface configuration of both the principal planes of said piezo electric crystal layer is a triangle.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the piezo resonator by which the flat-surface configuration of a piezo electric crystal layer was improved especially about the piezo resonator used for a piezo-electric radiator, a piezo-electric filter, etc.
[0002]
[Description of the Prior Art] Drawing 2 and drawing 3 are each perspective view showing the well-known piezo resonator using the flare oscillation mode. The piezo resonator 1 shown in drawing 2 has the structure which formed electrodes 3 and 4 in both the principal planes of the disc-like piezo-electric plate 2. The piezo resonator 1 is mainly used as a piezo resonator using resonance of flare vibration of a disk. On the other hand, the piezo resonator 5 shown in drawing 3 has the structure with which the flat-surface configuration formed electrodes 7 and 8 in both the principal planes of the square piezo-electric plate 6, and this piezo resonator 5 is used as a piezo resonator which mainly used resonance of a rectangular flare vibration. By the way, when using piezo resonators 1 and 5 for concrete devices, such as a filter and a radiator, by the piezo resonator 1, the resonance frequency of piezo resonators 1 and 5 is determined by the diameter of the piezo-electric plate 2, and is determined with the dimension of one side of the piezo-electric plate 6 in a piezo resonator 5.
[0003]
[Problem(s) to be Solved by the Invention] As mentioned above, when the conventional piezo resonators 1 and 5 were used for a filter, a radiator, etc., resonance frequency was determined with the dimension of the piezo-electric plates 2 and 6. Therefore, in order to make in agreement the operating frequency in the case of using it as a filter or a radiator, and the resonance frequency of piezo resonators 1 and 5, as long as piezo resonators 1 and 5 were used, the magnitude of resonators 1 and 5 was determined by the operating frequency. Consequently, when you wanted to attain the miniaturization of equipment using a smaller piezo resonator, it was not able to respond by the conventional piezo resonators 1 and 5 to use a reverse more big piezo resonator.
[0004] The purpose of this invention cancels the fault of the conventional piezo resonator, and even if an operating frequency is the same, it is to be small more or make it possible to offer a large-sized piezo resonator.
[0005]
[Means for Solving the Problem] This invention is characterized by the flat-surface configuration of both the principal planes of a piezo electric crystal layer being n square shape (however, integer excluding [n] three or more 4) in the piezo resonator by which at least two or more electrodes for excitation were formed in both the principal planes of this piezo electric crystal layer on both sides of the piezo electric crystal layer.
[0006]
[Function] Although resonance frequency changed in the resonator using a piezo electric crystal with oscillation modes to be used, resonance frequency was determined with the dimension of a resonator by each oscillation mode as mentioned above. Since the piezo electric crystal layer principal plane in which the electrode for excitation of a piezo resonator was formed is made into n square shape (however, integer excluding [n] three or more 4) as mentioned above, an oscillating style can change and it can be made to resonate on various frequencies with the value of n in this invention. Therefore, by choosing the piezo resonator of various configurations which changed the value of Above n, even if it is the same operating frequency The thing of a high-frequency field which became small too much OK and conventionally and was not able to use the small piezo resonator which was not obtained conventionally is spread. Realize using the oscillation mode or Or it becomes possible to oppress spurious one which spreads by changing n by the resonator using other oscillation modes, and originates in the higher mode of vibration.
[0007] Moreover, like, when [according to claim 2] the flat-surface configuration of both the principal planes of a piezo electric crystal layer is a triangle, when die length of one side is the same, the resonator of higher resonance frequency can be obtained compared with the case of a square. Therefore, though it is the same use frequency, a piezo resonator smaller than before can be offered.
[0008]
[Example] Drawing 1 is the perspective view showing the piezo resonator of one example of this invention. The piezo resonator 11 of this example has the structure with which the flat-surface configuration formed the electrodes 13 and 14 for excitation in both the principal planes of the triangular piezo electric crystal layer 12. A piezo resonator 11 is producible with the following procedures. First, after preparing the veneer with a thickness of 500 micrometers it is thin from titanic-acid lead zirconate system electrostrictive ceramics and applying conductive paste to both the principal planes of this veneer, into a 100-degree C oil, the

electrical potential difference of 1kV is impressed in the thickness direction, and polarization processing is performed. Next, the above-mentioned piezo resonator 11 is obtained by cutting to the equilateral triangle whose die length of one side is 3mm so that it may have the flat-surface configuration shown in drawing 1 in the veneer which consists of the above-mentioned piezo electric crystal ceramics.

[0009] Drawing 4 shows the impedance-frequency characteristics (continuous line A) of the piezo resonator 11 of the above-mentioned example, and the impedance-frequency characteristics (broken line B) of the piezo resonator (equivalent to the conventional piezo resonator 5 shown in drawing 3) of the square whose one side produced by the same approach as the above is 3mm. Though each of one side will be a 3mm piezo resonator if the impedance-frequency characteristics of the piezo resonator 11 of an example and the piezo resonator of the conventional example are compared so that clearly from drawing 4 , in the piezo resonator 11 of an example, it turns out that it may resonate in a high region compared with the piezo resonator of the conventional example.

[0010] That is, if die length of one side is the same, it turns out that the piezo resonator 11 of an example which has the flat-surface configuration of an equilateral triangle may resonate more in a RF region compared with a square piezo resonator. On the contrary, in the piezo resonator 11 of an example, most, when [of the piezo resonator of the conventional example which has the flat-surface configuration of the above-mentioned square for the resonance frequency of the resonance point by the side of low frequency] you tried to make it most in agreement with the resonance frequency of the resonance point by the side of low frequency, according to the experiment of invention-in-this-application persons, it turned out that it is necessary to set die length of one side of the piezo resonator 11 of an equilateral triangle to about 3.7mm.

[0011] However, at the piezo resonator which has the flat-surface configuration of an equilateral triangle where die length of one side is 3.7mm, the area of this equilateral triangle is 2 6mm. It is only weakness. therefore -- the piezo resonator of the square whose die length of one side is 3mm -- area -- 9mm2 it is -- a sake -- one side -- it is -- die length -- about 3.7mm -- large -- having carried out -- a case -- it is -- even if -- an example -- in a piezo resonator, it turns out that it can miniaturize or less in 2/3 by surface ratio. If a flat-surface configuration constitutes a piezo resonator using the piezo electric crystal layer of an equilateral triangle so that clearly from the above-mentioned example, compared with the piezo resonator 5 which has the flat-surface configuration of a well-known square, a smaller piezo resonator can be obtained from the former. In addition, the flat-surface configuration of a piezo electric crystal layer is possible also for considering as other triangles other than an equilateral triangle, and can make a piezo resonator smaller also in such a case compared with the conventional example.

[0012] Furthermore, if the piezo resonator of the above-mentioned example and the piezo resonator which has the flat-surface configuration of n square shape (however, integer excluding [n] three or more 4) so that clearly [a flat-surface configuration] from the comparison with a square piezo resonator are constituted, since oscillating styles differ, it turns out that a flat-surface configuration can realize a small or large-sized piezo resonator compared with a square piezo resonator.

[0013]

[Effect of the Invention] according to this invention, since the flat-surface configuration of both the principal planes of a piezo electric crystal layer is made into n square shape (however, integer excluding [n] three or more 4), resonance of the oscillation mode which was not used conventionally obtains -- having -- this -- ****** -- by using the oscillation mode, even if it is the same use frequency, the piezo resonator of various magnitude can be obtained. Therefore, it becomes possible like other electronic parts to miniaturize the magnitude remarkably also in the piezo resonator as which small and light-ization is demanded, to spread and to realize the piezo resonator of the high-frequency field which became small too much conversely and had a problem on handling using the oscillation mode, and to change n, to spread in the resonator using other oscillation modes, in a list, and to oppress spurious one of the higher mode of vibration.

[0014] Moreover, when the flat-surface configuration of both the principal planes of a piezo electric crystal layer is a triangle and a flat-surface configuration uses [according to claim 2] on the same use frequency like compared with the square conventional piezo resonator, it becomes possible to make the whole magnitude remarkably small.

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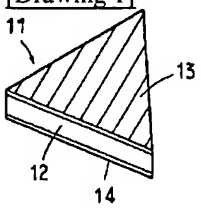
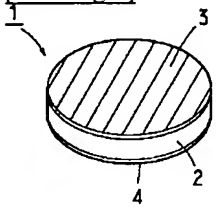
* NOTICES *

DRAWINGS

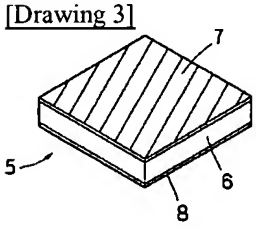
[Drawing 1]



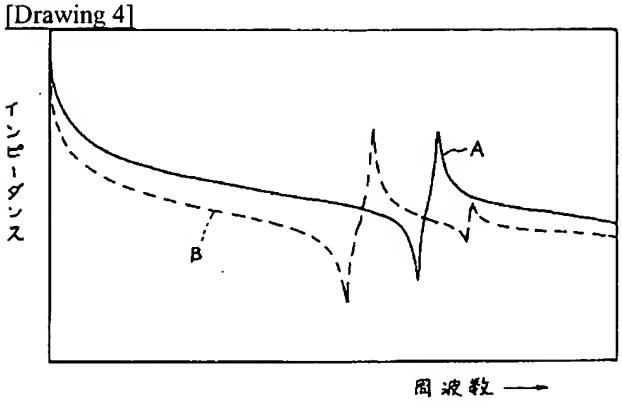
[Drawing 2]



[Drawing 3]



[Drawing 4]



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